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(54) Abstract Title
Inlet and vent duct for a laundry appliance

(57) A detergent dispenser 400 is connected to a washing liquid duct 520 and a flexible hose 550 to supply wash liquid to a tub 200. A vent duct 560 is coaxially mounted within the liquid duct. The vent duct is frusto-conically shaped with an outer surface 565 that is tapered and extends above the level of the outlet aperture of the washing liquid duct. A number of arms 562 support the vent duct within the liquid duct. The vent allows air to escape from the tub when wash liquid enters. A swirl inducing means may be provided at the entrance to the liquid duct.

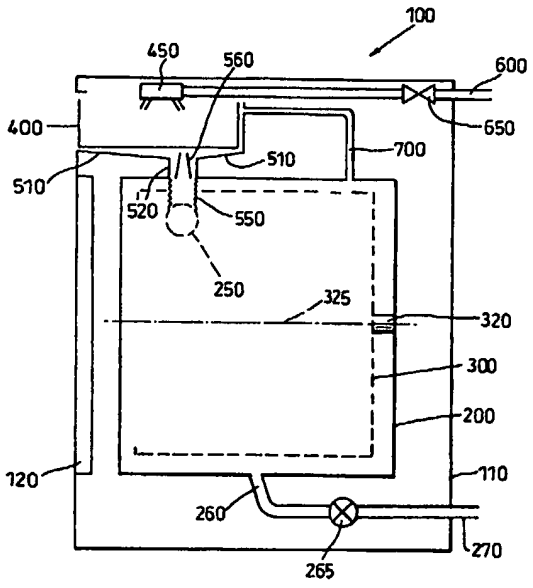

Fig. 2

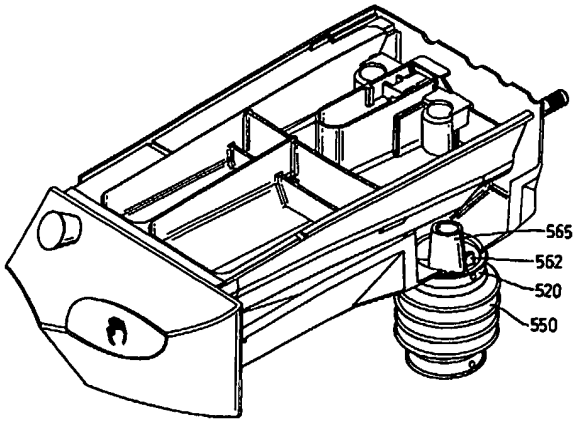

Fig. 4

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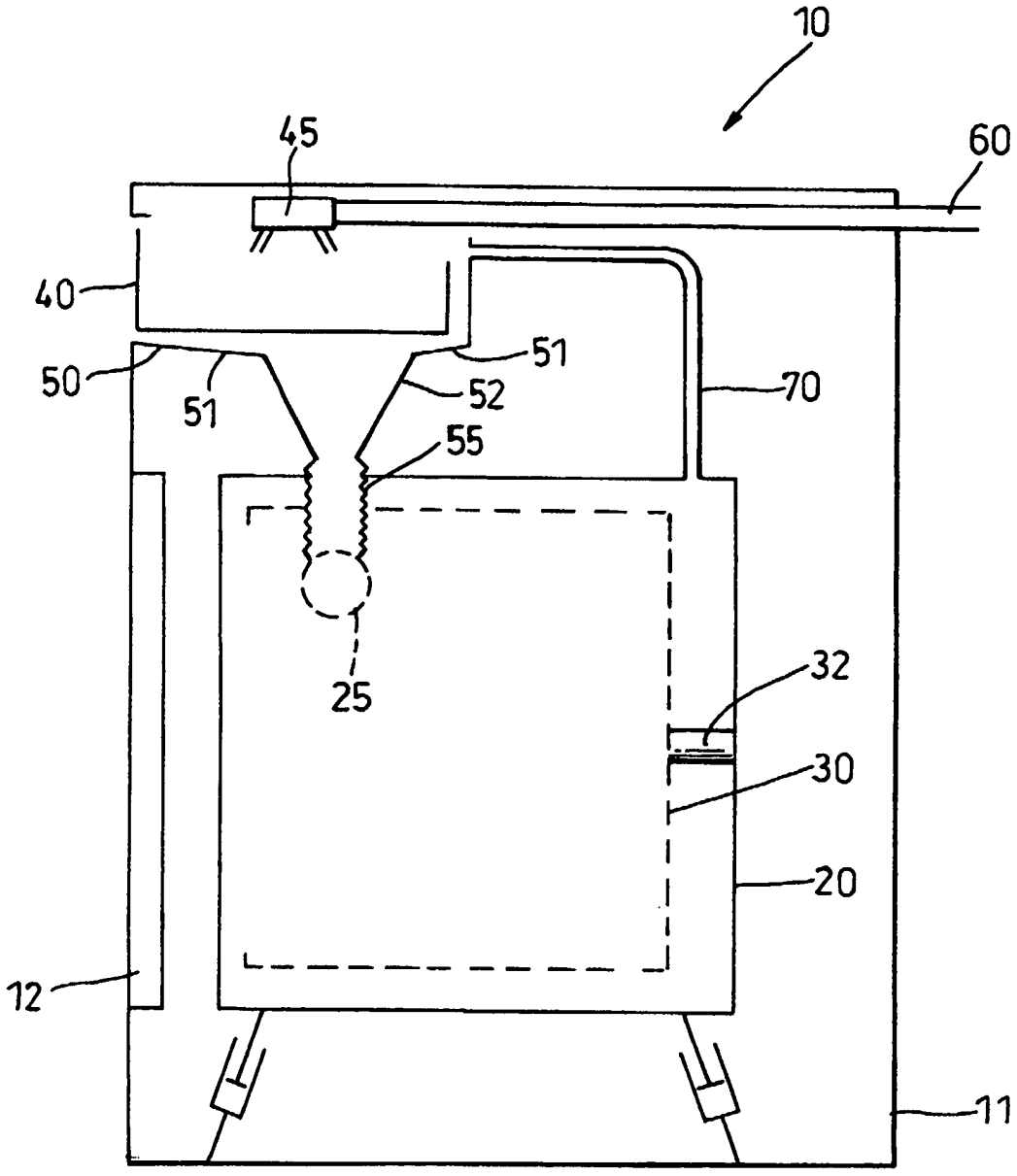
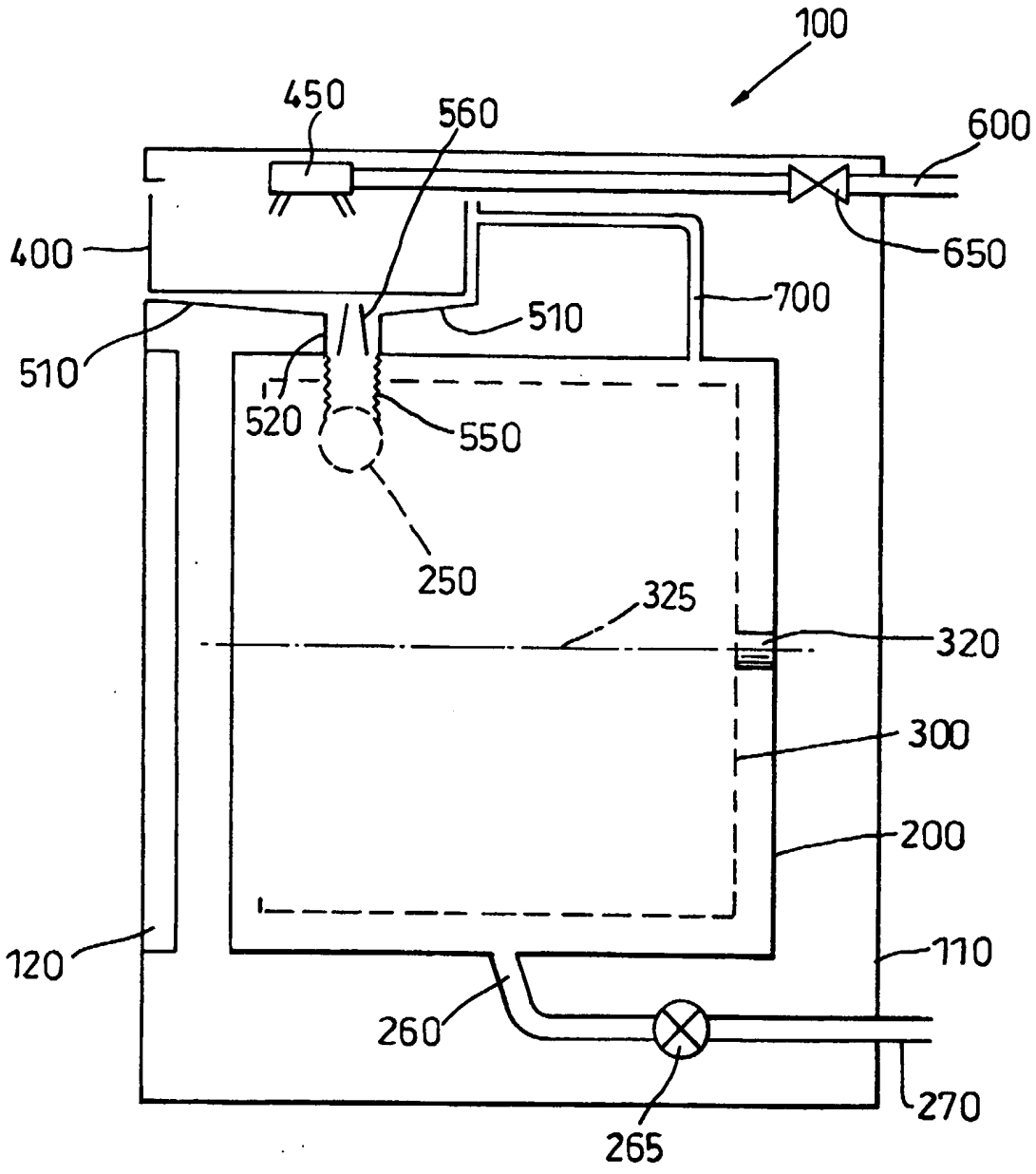


Fig. 1
(PRIOR ART)


100
450
560
600
400
650
700
510
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520
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325
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265

Fig. 2

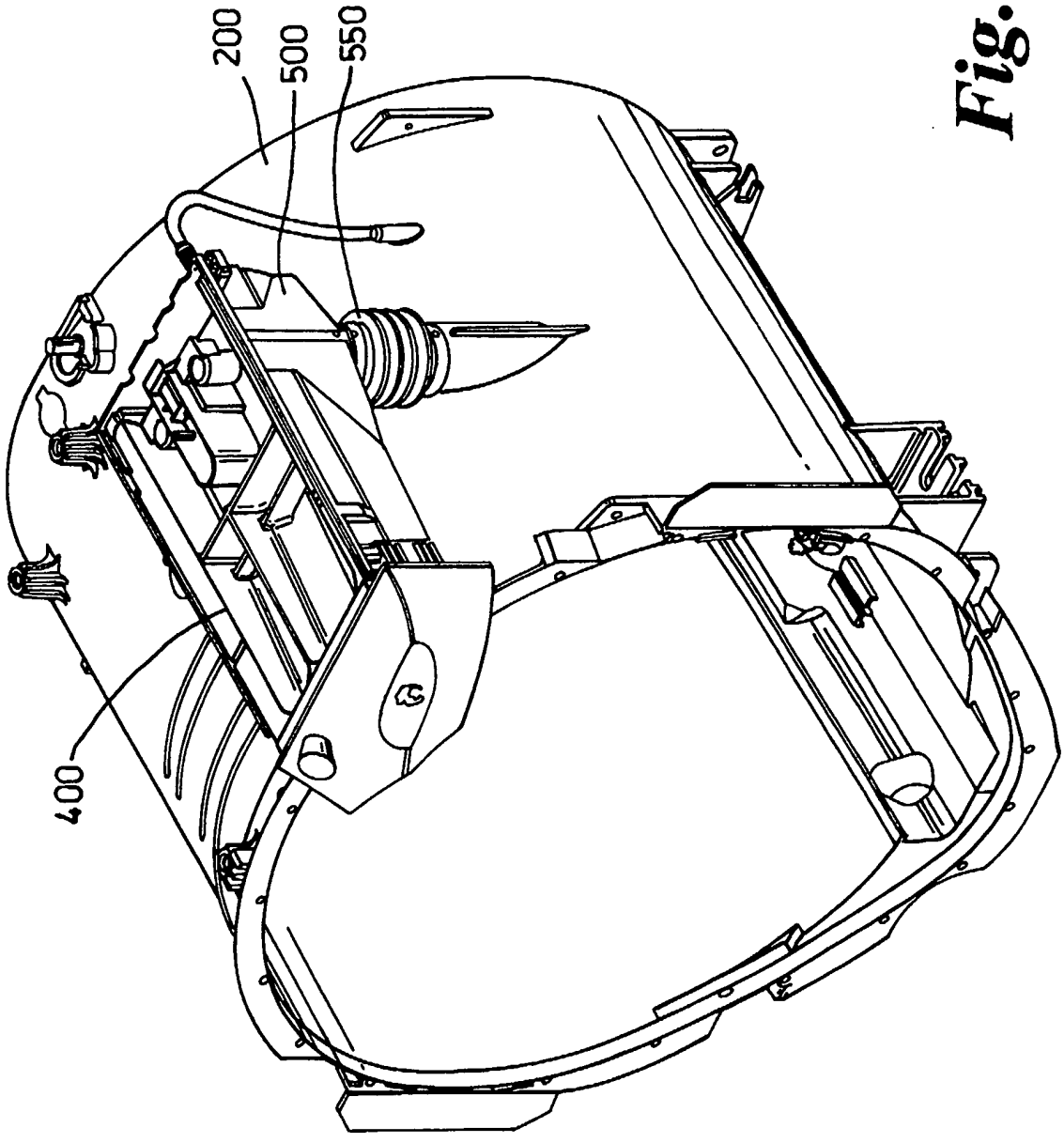

Fig. 3

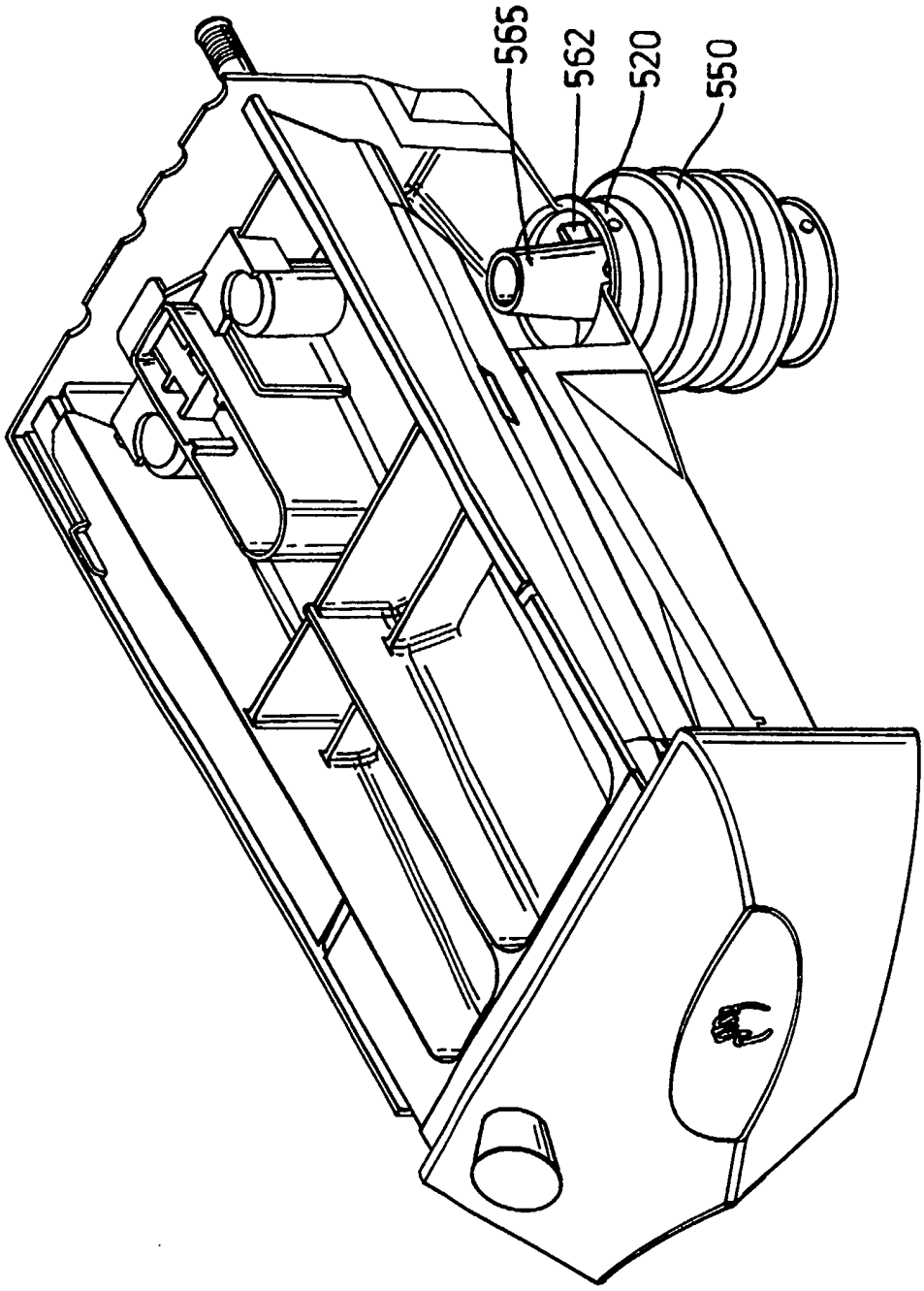

Fig. 4

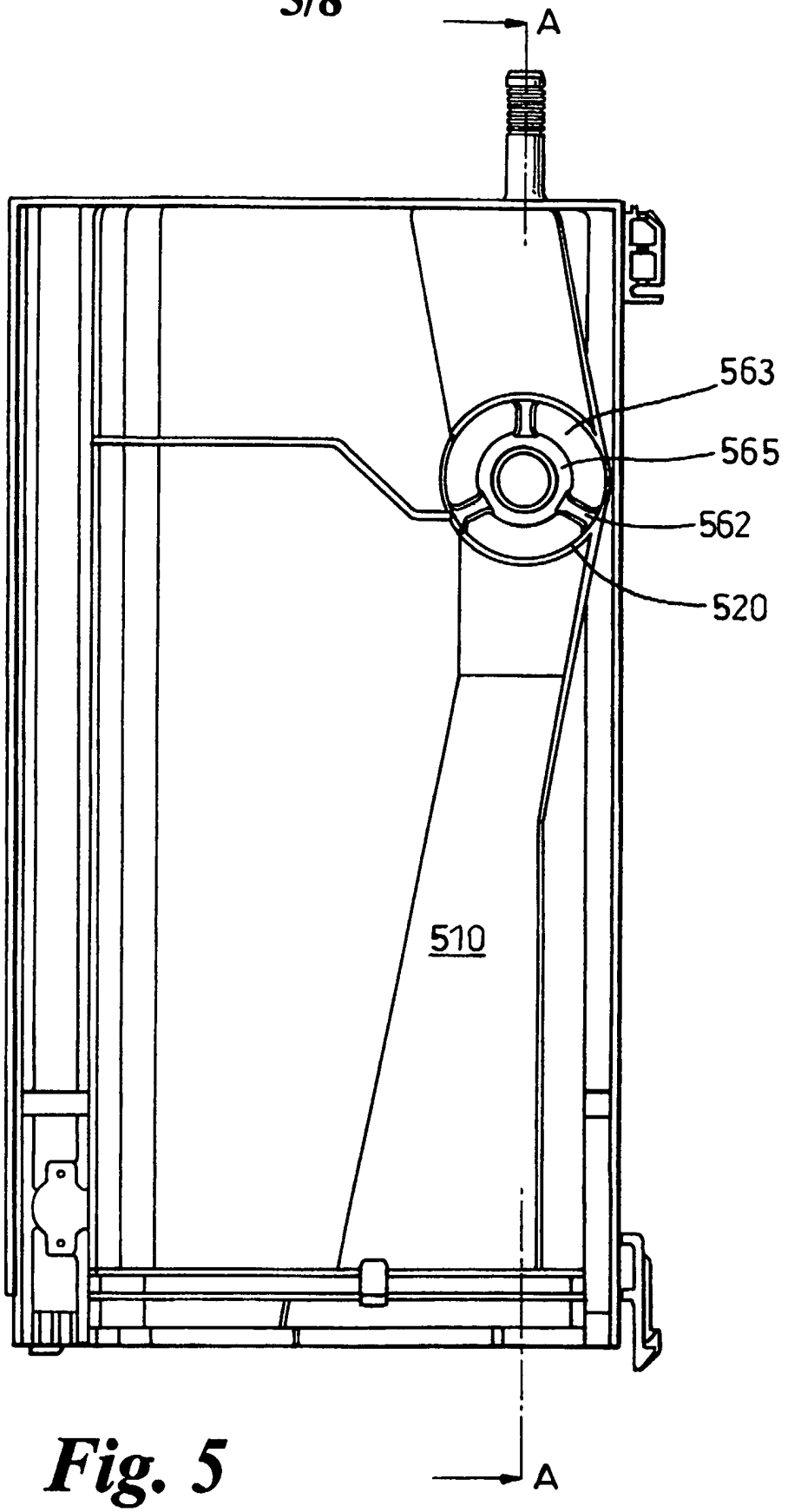

Fig. 5

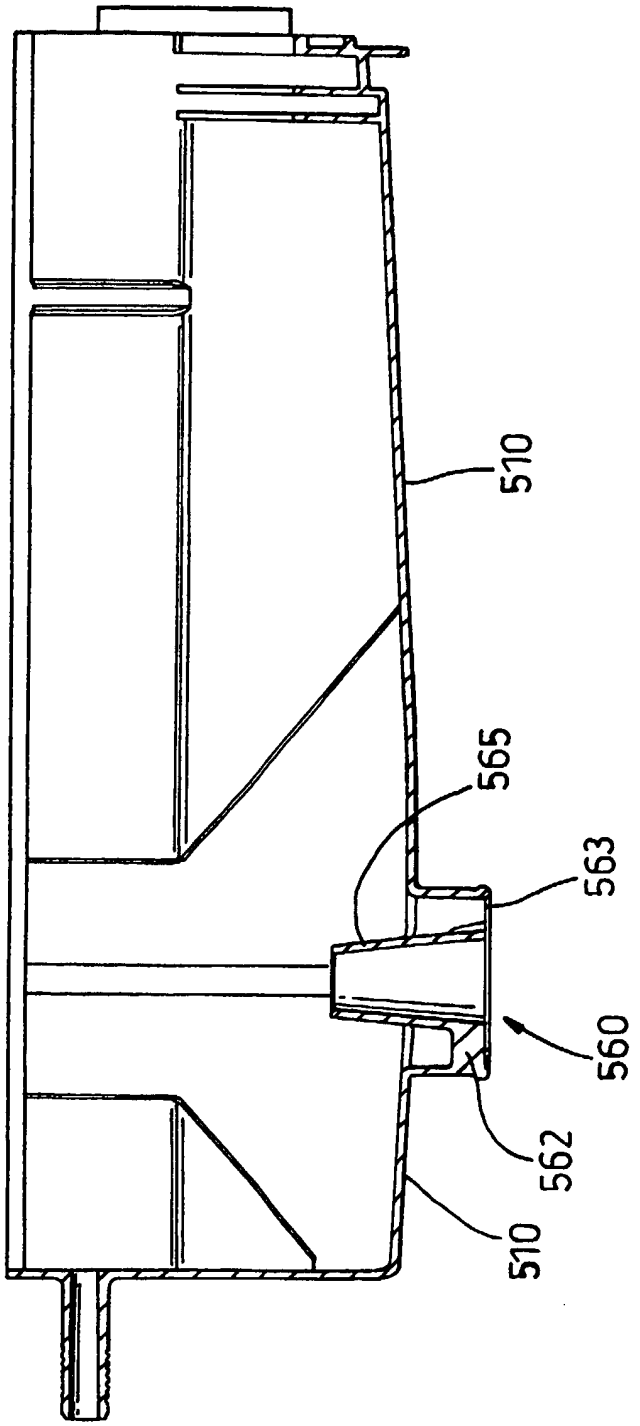

Fig. 6

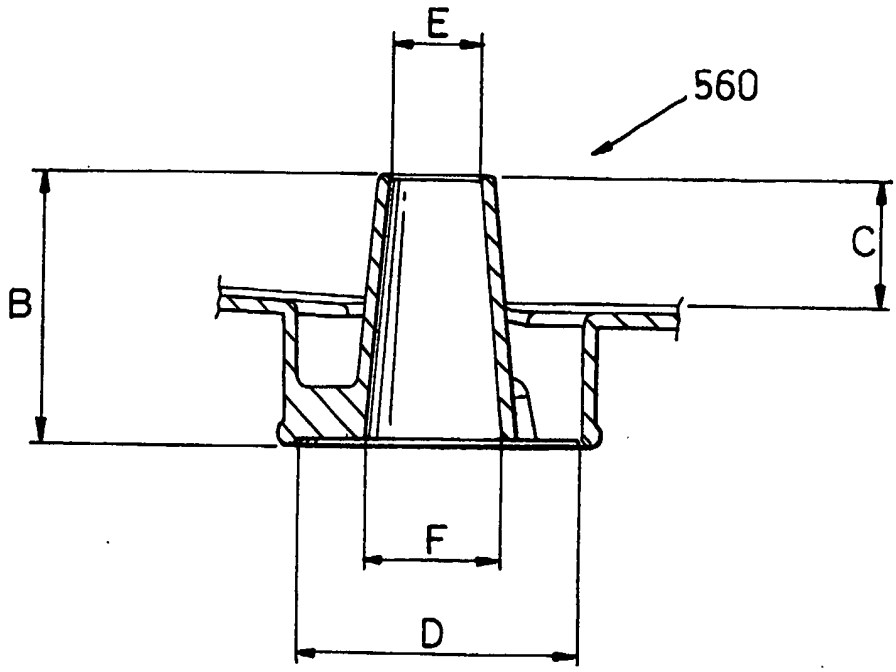

Fig. 7

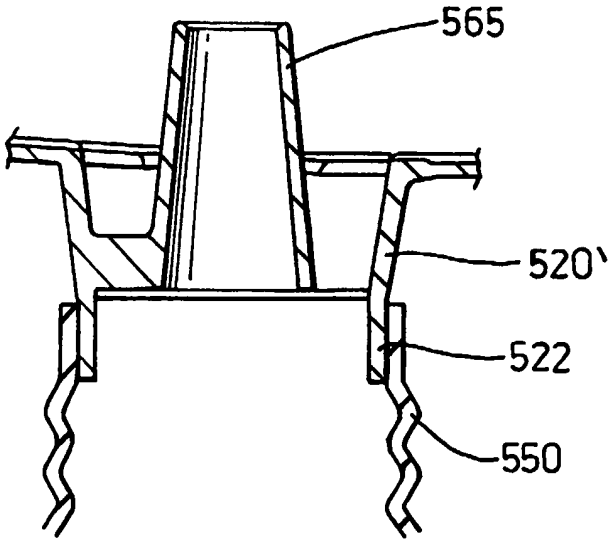

Fig. 8

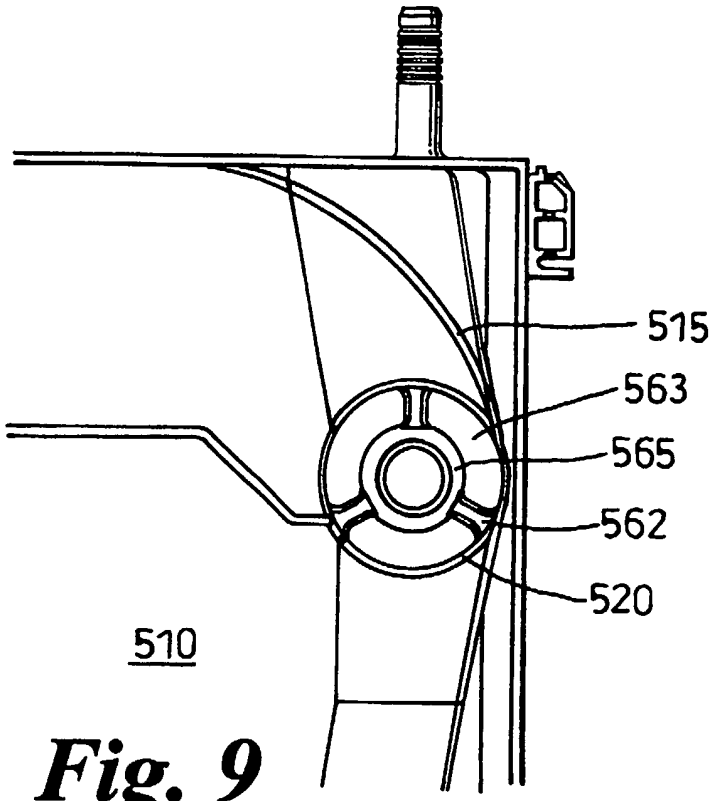

Fig. 9

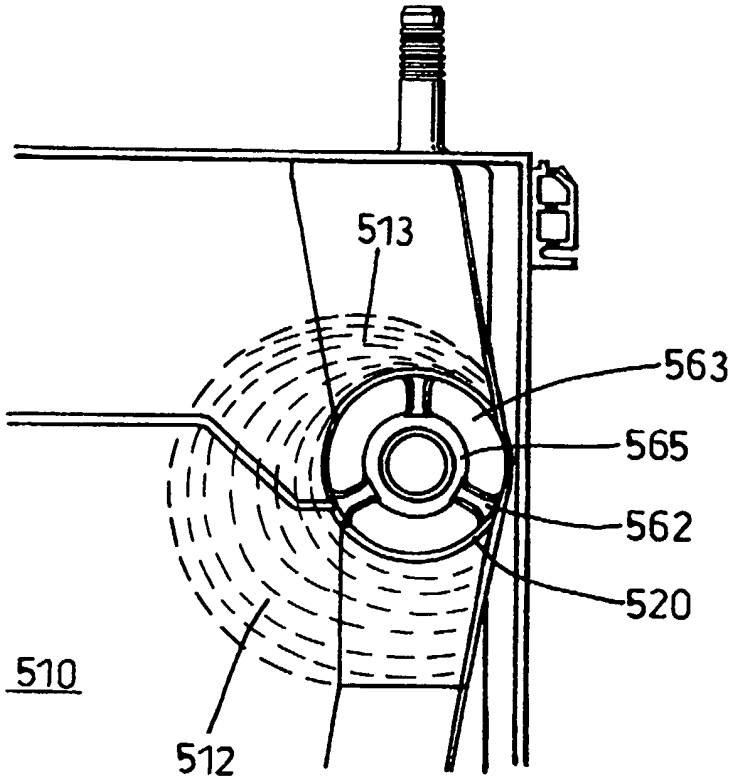

Fig. 10

Laundry Appliance

The present invention relates to a laundry appliance such as a washing machine or a washer-dryer.

As shown in Figure 1, a conventional washing machine 10 comprises a main casing 11 in which a tub 20 is mounted. A drum 30 is rotatably mounted inside the tub 20. Articles to be washed are placed in the drum 30 and, during a laundry cycle, the drum 30 is rotated within the tub 20 in the presence of water and detergent so as to agitate the articles and release dirt from the articles. The washing machine 10 also comprises a soap tray 40 which is slideably received in the front face of the machine. The soap tray holds a payload of detergent and conditioner for the laundry cycle. Water is admitted into the machine via an inlet pipe 60. Suitable distribution means 45 are provided for directing the incoming water into a compartment of the soap tray 40 or directly towards the tub 20. Water drains from the soap tray 40, or from the distributor 45, into the tub 20. The water is directed to the tub 20 via the sloping base 51 of the soap tray compartment 50, a duct 52 and a flexible hose 55. The flexible hose 55 allows the tub to move with respect to the duct 52 as the machine performs a laundry cycle.

In use, water or a water and detergent mixture, which will both hereinafter be referred to as wash liquid, passes into the tub 20 and displaces air from within the tub 20. The air exits the tub 20 via an air venting pipe 70 or via the hose 55 and duct 52. The space that exists within the casing 11 between the soap tray 40 and tub 20 allows the duct 52 to have a fairly large capacity. The capacity of duct 52 is sufficiently large that it can accept water at a fairly rapid rate without the water level rising above the duct.

There is a desire to increase the size of the drum of a washing machine. However, manufacturers are constrained by the size of the casing 11 into which the drum can be fitted, the casing 11 being of a standard size. Accommodating a larger drum within the casing of a washing machine presents problems for other features of the machine. In particular, a larger drum occupies much of the space that would normally be occupied

by the duct 52. Reducing the capacity of this duct has been found, under certain conditions, to cause water to overflow from the soap tray housing. This is clearly undesirable.

The present invention seeks to improve a laundry appliance.

Accordingly, the present invention provides a wash liquid inlet for a laundry appliance comprising a duct for carrying wash liquid to the interior of a wash liquid retaining tub of the appliance and a venting duct, wherein the venting duct is mounted within the wash liquid duct so as to allow air to escape from the interior of the tub when wash liquid flows along the wash liquid duct.

Mounting the venting duct within the wash liquid duct has the advantage that the tub of the machine can be rapidly filled with water without overflowing the soap tray housing. This is because the venting duct allows air to escape from the tub as water flows along the wash liquid duct. A further advantage of this system is that the conventional air venting duct can be removed, thus saving the cost of the venting duct and the time required to fit the part during assembly of the machine.

This invention is applicable to laundry appliances that have a drum which is positioned with its longitudinal axis in a horizontal position (generally front-loading machines) and to laundry appliances that have a drum which is positioned with its longitudinal axis in a vertical position (generally top-loading machines).

Preferably, the venting duct has an outer surface which tapers outwardly from the longitudinal axis of the wash liquid duct in the direction of flow of the wash liquid. This has an advantage of separating the wash liquid from the expelled air over a distance downstream of the venting duct. This allows the venting duct to be fairly short in length which minimises the possibility of the venting duct from rubbing a flexible hose positioned downstream of the duct.

Advantageously, swirl inducing means can be provided for inducing a swirling motion to wash liquid as it enters the wash liquid duct. The swirl inducing means can be one or more of the following: a shape of the lower surface of the housing which induces a swirling motion to wash liquid as it enters the wash liquid duct; a guide wall which is positioned on the lower surface of the dispenser; providing the wash liquid duct with a shape which is tapered towards the longitudinal axis of the wash liquid duct in the direction of flow of the wash liquid and directioning support arms, which support the venting duct within the wash liquid duct, so as to induce a swirling motion to wash liquid as it enters the wash liquid duct.

Other aspects of this invention are a detergent dispenser and a laundry appliance which incorporate the wash liquid inlet.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross-sectional view of a washing machine in accordance with the prior art;

Figure 2 is a schematic cross-sectional view of a washing machine in accordance with an embodiment of the invention;

Figure 3 is a perspective view of the tub and soap tray assembly of the washing machine;

Figure 4 is a perspective view of just the soap tray assembly of the washing machine;

Figure 5 is a view of the base of the soap tray housing shown in Figure 4;

Figure 6 is a cross-sectional view of the soap tray along section A-A of Figure 5;

Figure 7 is a more detailed view of the venting duct of the soap tray housing;

Figures 8 to 10 show alternative embodiments of the invention.

Figure 2 shows a washing machine 100 which includes an outer casing 110 in which a tub 200 is located. The tub retains washing liquid during a laundry cycle. The tub 200 is supported in a manner that allows the tub to move to a limited extent during use. This is achieved by mounting the tub 200 to the casing 110, or a supporting chassis (not shown) within the casing 110, by springs and dampers. A drum 300 is mounted inside the tub 200 so as to be rotatable by way of a shaft 320 about an axis 325. The shaft 320 is rotatably driven by a motor (not shown) mounted within the outer casing 110 of the washing machine 100. A door 120 is located in the front panel of the outer casing 110 to allow access to the interior of the drum 300.

The drum 300 can be a single drum of a conventional kind or it can comprise two drum portions which are mounted side-by-side such that they can be rotated with respect to one another. A drum of this type is described more fully in International Patent Application WO99/58753. The drum 300 is mounted in a cantilever fashion on the wall of the tub 200 remote from the door 120.

The tub 200 has an inlet 250, an outlet 260 and an air venting duct 700. The washing machine 100 includes a soap tray 400 which has a plurality of compartments for receiving liquid or powdered detergent in a known manner. The soap tray 400 is slideably received within a soap tray housing 500. At least one water inlet 600 communicates with the soap tray 400 and is provided with suitable means for connection to a water supply within the environment in which the washing machine 100 is to be used. Depending on local regulations, the washing machine 100 will either receive just a cold water inlet or both cold and hot water inlets. A distributor 450 receives water from the inlet 600 and distributes water to one of the compartments of the soap tray 400 or directly towards the inlet duct 520. Distributors are well known in the art. Two common forms of distributor are (i) a movable duct which is driven by a

motor so as to direct water to the compartment where it is required and (ii) a network of ducts, one duct for each compartment, each duct being selectively opened or closed by a valve.

The soap tray housing 500 has a lower surface 510 which slopes towards a duct 520. Duct 520 forms the drain outlet of the soap tray housing and the beginning of the inlet path to the tub 200. The duct 520 is joined in a watertight manner to a first end of a flexible hose 550. The other end of the flexible hose 550 is joined in a watertight manner to an inlet aperture 250 on the tub 200. The flexible hose 550 allows the tub to move with respect to the duct 520 as the machine performs a laundry cycle. The tub 200 has a sump located beneath the drum 300. A drainage pipe 260 communicates with the sump and leads to a drainage water outlet 270 by which water can be discharged from the washing machine 100. A pump 265 is provided to allow water to be pumped from the sump to the water outlet 270 at appropriate stages of the laundry cycle carried out by the washing machine 100.

Referring again to the soap tray housing, a hollow insert 560 is positioned within the duct 520 which connects the soap tray housing 500 with the flexible hose 550. In this embodiment, the insert 560 is mounted coaxially within the duct 520. The insert 560 has a frusto-conical shape with an outer surface 565 which tapers outwardly from the longitudinal axis of the duct in the direction of flow of liquid along the duct 520. The insert 560 is supported within the duct 520 by a plurality of arms 562. While three arms are shown here, it will be appreciated that other numbers of arms could equally be used. Each arm 562 has a leading edge which is tapered so as to minimise resistance to the flow of liquid. The insert 560 extends upwardly for a distance above the base 510 of the soap tray housing 500. The insert 560 serves as a venting duct which, in use, allows air to escape from the tub 200 as liquid flows into the tub. The distance by which the insert 560 protrudes upwardly is chosen such that it is short enough that it does not interfere with the movement of the soap tray, when the soap tray is pushed fully home in the soap tray housing, and long enough so that the insert helps to guide liquid into the duct 520 and to separate liquid flowing into the duct 520 from air exiting from the duct 520.

For a fast flow of wash liquid along the duct and hose it is necessary to separate the flow of wash liquid along the duct from air exiting the tub along the full length of the duct 520 and hose 550. It is possible for the insert 560 to extend lower than is shown in this embodiment. Indeed, the insert can be as long as the combined length of the duct 520 and hose 550 so as to ensure that the wash liquid and air are separated along the full length. However, it is undesirable for the insert 560 to extend too far beyond the duct 520 as the insert 560 can rub against the hose 550 under extreme movements of the tub 200. We have found that by providing a hose and duct which follow a substantially vertically oriented path and by outwardly tapering the insert 560, as shown in the Figures, it is possible to maintain an unrestricted path for the air as liquid flows into the tub while only requiring a short insert 560. Indeed, in the illustrated embodiment the lower end of the insert 560 is level with the lower end of duct 520. The vertical orientation of the duct 520 and hose 550 is achieved by positioning the aperture in the lower surface of the soap tray housing 510 substantially above the aperture 250 in the tub 200.

An air venting duct 700 connects an air vent on the tub 200 to an air inlet on the rear of the soap tray housing 500. With the provision of insert 560 within the duct 520, this venting duct 700 can be removed as sufficient air can now escape from the tub 200 through the insert 560.

Figure 7 is a more detailed view of the preferred embodiment of the venting duct. The dimensions are as follows:

B	overall height of venting duct	38mm
C	height of venting duct above soap tray housing base	18mm
D	diameter of wash liquid duct	42mm
E	diameter of venting duct at inlet end	14mm
F	diameter of venting duct at outlet end	21mm

It is preferred that the insert 560 and supporting arms 562 be formed integrally with the duct 520. This can be achieved by standard plastic moulding techniques. Alternatively, the insert 560 and arms 562 can be moulded as a separate part from the duct 520. In this alternative, it may be preferable to provide a ring which removably fits within the duct 520, with each of the support arms 562 being attached to the ring.

The machine 100 also has a control system. In a well-known manner, the control system receives inputs from various sensors on the machine and outputs control signals to operate various components of the machine, such as a motor which drives the drum 300 and a valve 650 for admitting water into the soap tray 400 at appropriate times during a laundry cycle.

In use, a user loads the drum 200 of the machine with laundry articles, selects an appropriate operating programme for the type of laundry, and starts the machine. The machine then performs a laundry cycle. The laundry cycle comprises a number of stages, including:

washing stages in which water is introduced into one of the detergent compartments so as to flush detergent out of the compartment and into the tub 200 of the machine, via the duct 520 and hose 550. The drum of the machine is rotated during this time so as to agitate the articles within the drum;

rinsing stages in which rinse water is introduced to the tub 200 directly via the duct 520, bypassing the detergent compartments of the soap tray; and,

spin stages in which the drum 200 is rotated very quickly about its axis 325.

During the washing and rinsing stages it is advantageous to fill the tub 200 with water (and detergent) as quickly as possible as this reduces the overall length of the laundry cycle. The provision of the venting duct 560 described above allows wash liquid to be introduced quickly by maintaining a free path for air to be displaced from the tub 200.

Some alternative embodiments of the invention will now be described. The preferred embodiment described above has a venting duct mounted coaxially within the duct 520.

While this is preferable, the venting duct can be positioned elsewhere within the duct 520, such as to one side of the duct. An alternative position of the venting duct can make it more difficult to control the flow of the liquid within the hose 550 downstream of the venting duct. Thus, if the venting duct 560 is positioned elsewhere within the duct 520 it may be necessary to extend the venting duct 560 further along the hose 550.

In alternative embodiments of the invention, shown in Figures 8 to 10, the soap tray housing 500 is modified so as to induce a swirl in wash liquid as it enters the duct 520. This can improve the flow rate of liquid through the duct 520. Figure 8 shows a similar cross-section through the duct 520 and insert 560 as Figure 7 except that the duct 520' has been modified so as to taper inwardly towards its longitudinal axis in the direction of flow of liquid. Thus the bottom of the duct 520' has a narrower diameter than the top of the duct. Also, to ensure a reliable seal between the hose 550 and duct 520' a cylindrical collar 522 extends downwardly from the tapered portion of the duct. The cylindrical collar 522 provides a surface to which the end of the hose 550 can be sealed. The swirling effect can be further enhanced by shaping supporting arms 562 such that they are aligned with the expected flow path of the swirling liquid. This results in the support arms being angled with respect to the longitudinal axis of the duct 520.

Figures 9 and 10 show two other modification that can be made to the soap tray housing 500. In Figure 9 a guide wall 515 is added to the soap tray housing 500. The wall 515 extends upwardly from the lower surface 510 of the soap tray housing. In the plan view of Figure 9 the wall 515 has a curved shape with one end of the wall 515 joining the edge of the duct 520 and the other end being positioned some distance away from the outlet. In use, the wall 515 serves to guide water towards the duct and to initiate a swirling movement about the insert 560.

In the modification of Figure 10 the shape of the lower surface 510 of the soap tray housing is modified in the area around the outlet. In region 512 the surface has a fairly shallow gradient. The gradient of the surface gradually increases in a clockwise direction around the perimeter of the outlet such that in region 513 the surface has a

fairly steep gradient. As with the wall 515, this modification to the gradient of the lower surface of the soap tray serves to guide water towards the duct and to initiate a swirling movement about the insert 560.

It is possible to use one or both of these modifications and to either use these modifications alone or in combination with the tapering duct shown in Figure 8.

Claims

1. A wash liquid inlet for a laundry appliance comprising a duct for carrying wash liquid to the interior of a wash liquid retaining tub of the appliance and a venting duct, wherein the venting duct is mounted within the wash liquid duct so as to allow air to escape from the interior of the tub when wash liquid flows along the wash liquid duct.

2. An inlet according to claim 1 wherein the venting duct has an outer surface which tapers outwardly from the longitudinal axis of the wash liquid duct in the direction of flow of the wash liquid.

3. An inlet according to claim 2 wherein the venting duct has a frusto-conical shape.

4. An inlet according to claim 2 or 3 wherein the wash liquid duct comprises a rigid portion and a flexible portion, and wherein the venting duct is located substantially within the rigid portion of the wash liquid duct.

5. An inlet according to any one of the preceding claims wherein the venting duct is mounted coaxially with the wash liquid duct.

6. A detergent dispenser for a laundry appliance comprising a housing for retaining detergent, the housing having a lower surface with an outlet aperture, the outlet aperture comprising, or being connected to, a wash liquid inlet according to any one of the preceding claims.

7. A detergent dispenser according to claim 6 wherein the venting duct extends beyond the outlet aperture so that the upper end of the venting duct lies above the lower surface of the housing in the region adjacent the aperture.

8. A detergent dispenser according to claim 6 or 7 wherein swirl inducing means are provided for inducing a swirling motion to wash liquid as it enters the wash liquid duct.

9. A detergent dispenser according to claim 8 wherein the swirl inducing means comprises a shape of the lower surface of the housing which induces a swirling motion to wash liquid as it enters the wash liquid duct.

10. A detergent dispenser according to claim 8 or 9 wherein the swirl inducing means comprise a guide wall which is positioned on the lower surface of the dispenser.

11. A detergent dispenser according to any one of claims 8 to 10 wherein the swirl inducing means comprise providing the wash liquid duct with a shape which is tapered towards the longitudinal axis of the wash liquid duct in the direction of flow of the wash liquid.

12. A detergent dispenser according to any one of claims 8 to 11 wherein support arms support the venting duct within the wash liquid duct and wherein the swirl inducing means comprise directioning the support arms so as to induce a swirling motion to wash liquid as it enters the wash liquid duct.

13. A laundry appliance comprising a casing, a tub, mounted within the casing, for retaining wash liquid and a detergent dispenser according to any one of claims 6 to 12.

14. A laundry appliance according to claim 13 wherein the tub has a diameter which is substantially equal to the width of the casing.

15. A laundry appliance according to claim 13 or 14 wherein the detergent dispenser is positioned within the casing above the tub and wherein the longitudinal axis of the wash liquid inlet is substantially vertical.

16. A laundry appliance according to any one of claims 13 to 15 wherein the venting duct is the only path for allowing air to escape from the tub as the tub is filled with wash liquid.

17. A laundry appliance according to any one of claims 13 to 16 wherein the laundry appliance is a washing machine.

18. A laundry appliance, a wash liquid inlet for a laundry appliance or a detergent dispenser for a laundry appliance substantially as described herein with reference to the accompanying drawings.

Application No: GB 0121535.9 **Examiner:** Ian Blackmore
Claims searched: 1-18 **Date of search:** 4 December 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): D1A (ADA, ADC, ADKA, ADKG, ADKL).

Int Cl (Ed.7): D06F 39/02, 39/08.

Other: Online: EPODOC, JAPIO, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 1234442 A (HOOVER) see figure 4	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.